Total Laparoscopic Gallbladder-Preserving Stone Extraction (Full Version)

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1. Definition and Principle

Total Laparoscopic Gallbladder-Preserving Stone Extraction is a minimally invasive surgical technique performed entirely via laparoscopy combined with choledochoscopy. It preserves the native gallbladder and only removes gallstones precisely. The gallbladder is never exteriorized from the abdominal wall during the whole procedure, featuring minimal trauma and high technical professionalism.

Dual-endoscope combination: Laparoscopy (providing overall abdominal vision) + rigid/flexible choledochoscopy (detailed intracavitary exploration of the gallbladder).

Core principles: Complete stone clearance, preservation of functional gallbladder, and tight suture of gallbladder wall incision.

2. Surgical Indications (Strict Screening)

Good gallbladder function: Gallbladder contraction rate ≥ 30% after fatty meal test. For acute obstructive cholecystitis caused by cystic duct or gallbladder neck stone impaction within 24 hours without gallbladder suppuration or gangrene, gallbladder-preserving surgery is also acceptable.

Intact gallbladder wall: Gallbladder wall thickness ＜ 4–5 mm, no atrophy, wall calcification, septal deformity, with smooth and intact gallbladder mucosa.

Suitable stone conditions: Single stone or less than 3 stones, stone diameter ＜ 3 cm, no severe impaction, and patent cystic duct.

Controllable inflammation: Non-severe acute cholecystitis; no gallbladder suppuration, gangrene or perforation.

Patient's willingness: Strong intention to preserve the gallbladder, full acknowledgment of stone recurrence risk, and willingness to receive long-term follow-up.

Exclusion of malignant risk: No gallbladder polyps or high-risk polyp lesions, and no suspected gallbladder malignancy.

3. Absolute Contraindications

1. Acute suppurative or gangrenous cholecystitis, gallbladder perforation.
2. Congenital or acquired gallbladder malformation and severe gallbladder atrophy.
3. Gallbladder polyps ≥ 1 cm or clinically and radiologically suspected malignant lesions.
4. Severe cardiopulmonary diseases unable to tolerate general anesthesia and pneumoperitoneum, or other severe underlying diseases unsuitable for surgical intervention.

4. Relative Contraindications

1. Full-stone gallbladder.
2. History of biliary pancreatitis or severe cystic duct obstruction.
3. Mirizzi syndrome and gallbladder wall thickness ＞ 5 mm.
4. Patients over 60 years old who fully acknowledge the risks of postoperative stone recurrence and secondary surgery but strongly request gallbladder-preserving surgery rather than cholecystectomy.

5. Standard Surgical Procedures (Total Laparoscopic 3-port Technique)

After general anesthesia and pneumoperitoneum establishment, a standard 3-port approach is adopted: a 1 cm umbilical port for observation, a 0.5 cm subxiphoid main operating port, and a 0.5 cm right mid-clavicular subcostal auxiliary operating port.
Comprehensive abdominal exploration is performed to evaluate gallbladder morphology, inflammatory severity, abdominal adhesion status and stone location.
Two traction sutures are placed at the gallbladder fundus, with the suture tails extracorporeally fixed via the auxiliary port to fully expose the surgical field.
A tiny incision of approximately 0.2 cm is made at the gallbladder fundus between the two traction sutures using an electrosurgical knife.
The laparoscopic sheath of the auxiliary port is removed, and a patented special sheath for gallbladder-preserving lithotomy is inserted through the fundus incision to establish a dedicated extracorporeal–intra-abdominal–intracholecystic working channel.
A rigid choledochoscope is inserted through the special sheath. All stones and biliary sludge are completely removed under direct vision with a stone basket. Patency of the cystic duct and normal bile reflux are confirmed. The gallbladder mucosa and wall are explored to

be smooth, intact and free from active bleeding and malignant lesions.
Intraoperative cholangiography via the fundus sheath is performed to verify the patency of the gallbladder, cystic duct and common bile duct, and to clearly identify the cystic duct insertion pattern, morphology and outlet structure of the common bile duct, as well as the diameter, length and course of the cystic duct.
The gallbladder wall incision is closed with layered absorbable sutures under laparoscopy.
After thorough abdominal irrigation, no active bleeding or bile leakage is confirmed. The peritoneal and fascial layers of the umbilical observation port are sutured with absorbable sutures, followed by skin adhesive closure. The main and auxiliary port incisions are closed only with skin adhesive without suture removal required. No abdominal drainage tube is routinely placed, and the operation is completed.

6. Technical Advantages (Compared with Traditional Cholecystectomy and Mini-incision Gallbladder-Preserving Surgery)

Preservation of physiological function: Retains the native bile storage and concentration functions of the gallbladder, avoiding long-term postoperative complications such as post-cholecystectomy diarrhea, dyspepsia and gastroesophageal reflux.
Superior minimally invasive effect: Only three tiny puncture wounds of 0.5–1 cm, featuring minimal trauma, mild postoperative pain, less intraoperative blood loss and excellent cosmetic outcomes.
Thorough stone clearance: Direct visualization under choledochoscope ensures precise stone removal with a stone clearance rate over 95%.
Minimal abdominal disturbance: Totally closed intra-abdominal operation reduces postoperative visceral adhesion and overall complication rates.
Rapid postoperative recovery: Patients can ambulate on the first postoperative day and be discharged within 1–2 days, with short hospitalization and fast return to daily life.

7. Surgical Risks and Limitations

Stone recurrence: Under strict indication screening, the 5-year stone recurrence rate is approximately 5%–10%, which can be reduced to within 5% with rigorous surgical criteria and standardized postoperative management.

High technical threshold: Precise laparoscopic gallbladder incision and layered suturing are technically demanding, with potential risks of bile leakage and abdominal bleeding caused by improper manipulation.
Limited indications: Only applicable to patients with qualified gallbladder morphology, intact function and favorable stone conditions.
Adequate clinical evidence: More than 20 years of clinical application in China has verified the safety, maturity and feasibility of the technique, with superior long-term comprehensive benefits compared with cholecystectomy.

8. Postoperative Management (Core Strategies for Preventing Stone Recurrence)

Dietary management: Maintain regular three-meal diet with high-fat breakfast; achieve balanced diet and calorie control; strictly abstain from alcohol and ensure adequate daily water intake.
Medication intervention: Standard administration of ursodeoxycholic acid for 6–12 months, combined with cholagogic proprietary Chinese medicines for auxiliary conditioning if necessary.
Regular follow-up: Abdominal ultrasonography at 1, 3, 6 and 12 months postoperatively, followed by annual routine review.
Lifestyle management: Rational weight control, stable blood glucose regulation and regular moderate exercise to improve systemic metabolism.

9. Summary and Clinical Selection Recommendations

Total Laparoscopic Gallbladder-Preserving Stone Extraction is a mature organ-preserving minimally invasive technique based on strict preoperative evaluation and precise indication screening, which is especially suitable for young patients with intact gallbladder function, few stones and strong willingness to preserve the gallbladder.
Preferred for gallbladder-preserving surgery: Patients under 60 years old, asymptomatic or mildly symptomatic biliary colic, single stone, normal gallbladder function and no obvious chronic inflammation.
Preferred for cholecystectomy: Patients with recurrent biliary colic, severe acute cholecystitis, full-stone or complex multiple gallstones, gallbladder wall thickening and atrophy, high-risk gallbladder polyps, or diabetes with poor metabolic control. These

patients suffer from irreversible damage to gallbladder nerve and contractile function, accompanied by extremely high risks of postoperative recurrence and infection. Gallbladder-preserving lithotomy is strictly prohibited, and cholecystectomy is the first choice clinically.

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